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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/749,986	12/31/2003	Donald S. Gardner	42P18458	9962

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EXAMINER	
DUPUIS, DEREK L	

ART UNIT	PAPER NUMBER
2883	

DATE MAILED: 12/12/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/749,986	GARDNER ET AL.	
	Examiner	Art Unit	
	Derek L. Dupuis	2883	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 September 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *32-50,52-54 and 56-62* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *32-50, 52-54 and 56-62* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *20 April 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *7/27/06 & 10/4/06*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments, see page 7, filed 9/21/2006, with respect to the objection to claim 43 have been fully considered and are persuasive. The objection to claim 43 has been withdrawn.

2. Since claim 55 has been cancelled by applicant's amendment, the outstanding rejection to this claim is moot and is therefore withdrawn.

3. Applicant's arguments, see page 8, in combination with the amendment to the claims filed 9/21/2006, with respect to the objection to claims 32 and 44 have been fully considered and are persuasive. The objections to claims 32 and 44 have been withdrawn.

4. Applicant's arguments filed 9/21/2006 regarding the interpretation of the LoCascio reference have been fully considered but they are not persuasive. Applicant states that LoCascio does not teach or suggest a pump disposed above the microresontator to excite recirculation of light in the microresonator. The examiner respectfully disagrees with this assertion. As is understood in the art, optical pumping is a process in which light is used to raise (or "pump") electrons from a lower energy level to a higher one (also called population inversion). This is described in column 1, lines 10-26 of Moulton et al (US 5,774,489). This reference is intended as a teaching reference to explain the process of optical pumping as is understood in the art.

5. LoCascio teaches that electrons in a saturable absorber material are excited from one energy level to another by photons from a light intensity beam (see paragraphs 45, 46, 52, 53, 79, and 81). While the term "optical pumping" is not used, the process of optical pumping is never-the-less disclosed. Further support for this can be found in paragraphs 37 and 41. In paragraph

41, the refractive index of 1.45 is explained to be "the index of refraction of the quantum dot saturable absorber material under no illumination *(ie., not pumped)*." In paragraph 37, the optical control beam illuminates the quantum dot material and thus changes the index of refraction through a change in the energy levels of the electrons of the material as is explained in paragraphs 28, 45, 46, 52, 53, 79, and 81). As is understood in the art, changing the energy level of electrons via illumination from a control beam is by definition optical pumping.

6. Applicant's arguments with respect to claims 32-50, 52-54, and 56-62 have been considered but are moot in view of the new ground(s) of rejection. The new grounds of rejection make this rejection non-final.

Information Disclosure Statement

7. The information disclosure statements (IDS) submitted on 7/27/2006 and on 10/4/2006 were filed after the mailing date of the non-final rejection on 3/23/2006. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statements have been considered by the examiner.

Drawings

8. The drawings were received on 4/20/2006. These drawings are accepted.

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claims 32-43, 45-50, 53, 54, and 56-62 are rejected under 35 U.S.C. 103(a) as being unpatentable over ***Garito et al (US 6,876,796 B2)*** in view of ***LoCascio et al (US 2003/0016907 A1)*** and in further view of ***Moulton et al (US 5,774,489)***.

11. Regarding claims 32-35, 40-43, 45, 47, 50, 53, 54, and 56-62, Garito et al teach an apparatus comprising a silicon substrate (100) and a microresonator (50) disposed on the substrate. The microresonator has an annular structure to recirculate light at a desired wavelength (see column 4, lines 53-57 and column 14, lines 9-23). Garito et al teach that the microresonator includes nanocrystals and a rare earth in a matrix (see column 1, lines 10-13, column 2, lines 40-61, column 4, lines 45-57, column 9, lines 11-25, and column 15, lines 53-60). Garito et al teach that the nanocrystals can include Si or SiGe (see column 8, line 61 to column 9, line 10) and that the matrix can be aluminosilicate (see column 2, line 66 to column 3, line 6). Garito et al teach that the rare earth to be included in the matrix can be any rare earth known to one skilled in the art (see column 9, lines 22-25). Erbium and Ytterbium are known rare earths.

12. Garito et al do not teach that the device includes a pump to excite circulation of light in the microresonator. LoCascio et al teach a microresonator that is optically pumped vertically from above to excite circulation in the microresonator. Through the optical pumping, LoCascio is able to selectively resonate a wavelength in the microresonator (see paragraph 81). LoCascio et al also disclose a microresonator coupled to a plurality of patterned waveguides (106 and 107) that are formed on the substrate. The waveguides are vertically coupled to the microresonator at a location below the microresonator as can be seen in figure 12. LoCascio et al do not explitily state that the waveguides are located above the microresonator. However, it would have been

obvious to one of ordinary skill in the art to place the waveguides above the microresonator (instead of below) since it has been held that the rearranging of parts of an invention involves only routine skill in the art. In re Japikse, 86 USPQ 70.

13. It would have been obvious to one of ordinary skill in the art at the time of invention to modify the device of Garito et al to include pumping as taught by LoCascio et al. Motivation to do this would be that the nanocrystal arrangement used by LoCascio allows for controlling and "altering the resonant condition of the microcavity" through the illumination provided by the pump source (see paragraph 26). This allows the resonator to resonate wavelengths of any size (see paragraph 52).

14. Garito et al and LoCascio et al do not explicitly state that an LED is used to pump the microresonator. Moulton et al teach that LEDs can be used to optically pump a medium and that this is routine in the art. See column 1, lines 10-27. The LEDs are capable of pumping below 900nm and are low power LEDs (see column 5, lines 25-40).

15. It would have been obvious to one of ordinary skill in the art at the time of invention to modify the device taught by Garito et al in view of LoCascio et al to include an LED pump source as taught by Moutlon et al. Motivation to do this would be pump efficiency of LEDs is higher (see column 1, lines 10-27).

16. Regarding claims 36-39, 48, and 49, Garito et al in view of LoCascio et al in further view of Moulton et al teach a device as discussed above in reference to claims 32 and 45 respectively. Garito et al teach that the annular structure can be a ring or a disk (see column 14, lines 9-37). Garito et al teach that the optical energy within the microresonator can be resonant in a standing wave mode (see column 14, lines 9-37)). By definition, a microresonator where the energy is

resonant in a standing wave mode is inherently has a circumference that is an integer multiple of the wavelength of the optical signal. The length from the center of the disk to the center of the waveguide forming the disk is, by definition, the radius of the disk. Therefore, radius of the disk is proportional (by 2π) to the circumference which is an integer multiple of the wavelength of the optical signals being resonated in the microresonator. By definition, a disc structured microresonator where the energy is resonant in a standing wave mode inherently has a perimeter that is an integer multiple of the wavelength of the optical signal.

17. Regarding claim 46, Garito et al in view of LoCascio et al in further view of Moulton et al teach a device as discussed above in reference to claim 45. LoCascio et al teach that the microresonator and the waveguides are in contact with one another (see figure 12). This range is less than 250 nanometers.

18. Claims 44 and 52 are rejected under 35 U.S.C. 103(a) as being unpatentable over ***Garito et al (US 6,876,796 B2)*** in view of ***LoCascio et al (US 2003/0016907 A1)*** and in view of ***Moulton et al (US 5,774,489)*** as applied to claims 32-43, 45-50, 53, 54, and 56-62 above, and further in view of ***Chan et al (US 6,236,060 B1)***.

19. Regarding claims 44 and 52, Garito et al in view of LoCascio et al in view of Moulton et al teach a device as discussed above in reference to claims 32 and 45 respectively. Garito et al nor LoCascio et al explicitly state that the pump excites circulation by tunneling current through silicon dioxide to form electron-hole pairs in the nanocrystals.

20. Chan et al teaches a light emitting device comprising electrically conductive materials. Chan et al teaches that it is well known to inject silicon nanocrystals or silicon-germanium nanocrystals into a layer of silicon dioxide (see column 3, line 59 to column 4, line 16 of Chan et

al). Chan et al teach that it is also well known in the art to tunnel current from a source to create electron-hole pairs in nanocrystals (see column 2, lines 43-55).

21. It would have been obvious to one of ordinary skill in the art at the time of invention to modify the micro-resonator of Garito et al in view of LoCascio et al by injecting silicon or silicon-germanium nanocrystals into a layer of silicon-dioxide and tunneling current through the layer to form electron-hole pairs in the nanocrystals as taught by Chan et al. Motivation to do this would be to result in a "high efficiency electroluminescent structure" (see column 2, lines 50-55 of Chan et al). Garito et al also suggest that the matrix material of the microresonator can include an added dopant or embedded active optical component (see column 15, lines 53-60). These suggestions would lead one of ordinary skill in the art to combine the teachings of Garito et al and Chan et al since Garito et al suggests adding a dopant or active optical element and since Chan et al suggests improved optical effects can be achieved by adding nano-crystals into an optical medium. Furthermore, additional motivation would be that it is common practice in the art to channel current through an oxide layer to form electron-hole pairs to excite energy.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Derek L. Dupuis whose telephone number is (571) 272-3101. The examiner can normally be reached on Monday - Friday 8:30am-4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Frank G. Font can be reached on (571) 272-2415. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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